

OPTICAL HAND TRACKING IN VIRTUAL REALITY SYSTEMS

CROSS REFERENCE TO RELATED APPLICATION

[0001] This application claims priority to U.S. Application No. 62/239,138, filed Oct. 8, 2015, which is incorporated by reference in its entirety.

BACKGROUND

[0002] The present disclosure generally relates to motion tracking, and specifically to using optical sensors for hand tracking in virtual reality or augmented reality applications.

[0003] Virtual reality (VR) is a simulated environment created by computer technology and presented to a user, such as through a VR system. Typically, a VR system includes a VR headset that provides visual and audio information to the user. However, when wearing the VR headset, the user is unable to see the user's hands or interact with the simulated environment presented by the VR headset with the user's hands. Conventional VR systems create virtual hands in the simulated environment and use a hand tracking system to track motion and positions of the user's hands. However, conventional hand tracking systems are often unable to accurately track positions of the user's fingers and thumbs, causing poor representation of movement of the user's fingers and thumbs by virtual hands of the user within the simulated environment.

SUMMARY

[0004] A system is configured to detect positions of a virtual reality (VR) input device (e.g., a tracking glove) in a VR environment, an augmented reality (AR) environment, a mixed reality (MR) environment, or some combination thereof. The system may track movement of the VR input device relative to a portion of a user's skin, track movement of the VR input device relative to a physical surface external to the VR input device, or both.

[0005] In some embodiments, the system includes an illumination source integrated with the VR input device coupled to a virtual reality console, and the illumination source is configured to illuminate a portion of skin on a finger of a user. For example, the illuminated portion of the finger is a portion of skin around a joint of the user's finger. The system may include an optical sensor integrated with the VR input device. The sensor is configured to capture a plurality of images of the illuminated portion of skin. The system includes a controller configured to identify differences between some of the plurality of images. For example, the differences correspond to movement of the VR input device with respect to the illuminated portion of the user's skin (e.g., detachment of the VR input device from the user wearing the VR input device, slip of the VR input device from the user, etc.). In another example, the differences correspond to movement of the illumination portion of the skin (e.g., movement of the finger). The controller is also configured to determine estimated position data based in part on the identified differences. For example, the controller determines estimated position data based on differences among common features identified in the plurality of images captured by the optical sensor. In another example, the controller determines estimated position data based on displacement vectors.

[0006] In some embodiments, the system includes an additional illumination source configured to illuminate a portion of surface external to an exterior of the tracking glove, and an additional optical sensor configured to capture a plurality of images of the illuminated portion of the surface. For example, the additional optical sensor has a field of view external to an exterior surface of the VR input device, and captures movement of the VR input device relative to the exterior surface in the field of view. The controller is further configured to identify differences between some of the plurality of images, and the differences corresponding to movement of the tracking glove with respect to the surface. The controller determines estimated position data based in part on the identified differences and identifies one or more actions performed by the user associated with content presented to the user based in part on the identified movement. Example actions performed by the user with presented content include: repositioning a cursor within content presented to the user, selecting content presented to the user, navigating through content presented to the user, typing action performed by the user, or some combination thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] FIG. 1 is a block diagram of a system environment including a virtual reality system, in accordance with an embodiment.

[0008] FIG. 2A illustrates a virtual reality input device, in accordance with an embodiment.

[0009] FIG. 2B illustrates a cross section of a portion of the virtual reality input device of FIG. 2A, in accordance with an embodiment.

[0010] FIG. 3 is a block diagram of the virtual reality input device in a virtual reality system, in accordance with an embodiment.

[0011] FIG. 4 is a flowchart of a process for tracking movements of a portion of skin through a motion tracking device, in accordance with an embodiment.

[0012] The figures depict embodiments of the present disclosure for purposes of illustration only. One skilled in the art will readily recognize from the following description that alternative embodiments of the structures and methods illustrated herein may be employed without departing from the principles of the disclosure described herein.

DETAILED DESCRIPTION

System Overview

[0013] FIG. 1 is a block diagram of a virtual reality (VR) system environment 100 in which a VR console 110 operates. The system environment 100 shown by FIG. 1 comprises a VR headset 105, an imaging device 135, and a VR input device 140 that are each coupled to the VR console 110. While FIG. 1 shows an example system 100 including one VR headset 105, one imaging device 135, and one VR input device 140, in other embodiments any number of these components may be included in the system 100. For example, there may be multiple VR headsets 105 each having an associated VR input device 140 and monitored by one or more imaging devices 135, with each VR headset 105, VR input device 140, and imaging device 135 communicating with the VR console 110. In alternative configurations, different and/or additional components may be